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Observations of Saturn's Ninth Satellite, Phœbe, *from Photographs taken with the* 30-*inch Reflector at the Royal Observatory, Greenwich, in* 1908.

(*Communicated by the Astronomer Royal.*)

Photographs of Phœbe have been taken with the 30-inch reflector during the recent opposition of Saturn, starting as early as practicable, so as to secure positions at eastern elongation. In all 23 photographs have been secured on 15 nights, between July 31, just before eastern elongation, and September 7, when the series was interrupted on account of Comet *c* 1908 (Morehouse).

The position of the satellite has been measured on photographs taken with the reflector with reference to faint comparison stars (of eleventh or twelfth magnitude), symmetrically distributed about the satellite. The positions of these faint comparison stars were then measured relatively to the reference stars (of eighth to ninth magnitude) on a photograph (with two exposures of 40^{m}) taken with the Astrographic 13-inch refractor. The field, sensibly free from distortion, being much larger with this telescope than with the reflector, 32 reference stars were available on the plate. As Saturn moved slowly, it was possible to make one reference plate serve for all the photographs, which were each referred to it. The constants were determined in the usual manner, all the stars on the plate given in the Astronomische Gesellschaft catalogues being used for this purpose. Right Ascensions and Declinations of the satellite were then determined, and compared with the corrected tabular places of Saturn after applying the corrections

in R.A. $+^{\mathrm{s}}\!\cdot\!08$ and Dec. $0''\!\cdot\!0$

as determined below.

The G.M.T. is the arithmetical mean of the times of beginning and end of exposure.

Observations of Phœbe.

Date and G.M.T.		Exp.	Apparent R.A.	Apparent Dec.	Phœbe − Saturn. R.A.	Phœbe − Saturn. Dec.
1908. d	h m	min.	h m s	° ′ ″	m s	′ ″
July 31	13 27·7	90	0 43 23·79	+1 59 42·4	+2 19·02	+17 41·0
Aug. 1	13 35·5	90	0 43 20·48	1 59 2·9	2 19·07	17 40·6
2	13 19·9	90	0 43 16·88	1 58 23·1	2 19·14	17 41·6
3	13 20·6	100	0 43 12·94	1 57 40·7	2 19·28	17 42·6
24	12 20·5	100	0 40 26·36	1 34 20·1	2 18·24	17 29·8
25	12 18·9	90	0 40 14·75	1 32 52·3	2 18·07	17 28·7
25	14 1·2	100	0 40 13·83	1 32 45·0	2 17·97	17 27·7
27	11 54·8	70	0 39 50·81	1 29 53·2	2 17·67	17 26·4
27	14 8·5	85	0 39 49·66	1 29 42·8	2 17·64	17 24·4
28	12 10·3	86	0 39 38·13	1 28 17·0	2 17·41	17 22·7
28	14 3·2	90	0 39 37·16	1 28 9·4	2 17·42	17 22·4
29	12 27·8	90	0 39 25·12	1 26 40·5	2 17·12	17 20·4
29	13 56·5	70	0 39 24·33	1 26 36·7	2 17·11	17 22·4
30	12 3·5	90	0 39 12·29	1 25 6·0	2 16·90	17 18·7
30	13 55·5	110	0 39 11·27	1 24 59·7	2 16·89	17 19·7

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Observations of Phœbe—continued.

Date and G.M.T.			Exp.	Apparent R.A.	Apparent Dec.	Phœbe - Saturn. R.A.	Phœbe - Saturn. Dec.
1908.	d	h m	min.	h m s	° ′ ″	m s	′ ″
Sept.	1	12 7·6	26	0 38 45·43	1 21 48·9	2 16·49	17 14·7
	2	12 6·0	80	0 38 31·44	1 20 10·8	2 16·06	17 14·9
	2	13 29·9	30	0 38 30·66	1 20 3·0	2 16·08	17 12·9
	2	14 35·5	90	0 38 30·04	1 19 58·2	2 16·08	17 12·7
	4	11 47·8	45	0 38 3·15	1 16 43·2	2 15·45	17 6·5
	4	13 11·6	100	0 38 2·36	1 16 37·9	2 15·48	17 7·1
	6	12 52·3	40	0 37 33·10	1 13 7·6	2 14·80	17 0·7
	7	13 33·6	31	0 37 17·62	1 11 17·1	2 14·44	16 57·3

Errors of Tabular Place of Saturn.

The positions of the satellite given above depend on the positions of certain stars taken from catalogues of the Astronomische Gesellschaft, and will be affected by the mean error in the places of these stars. To eliminate this it is necessary to determine the position of Saturn referred to the same stars.

For this purpose a number of photographs of Saturn were taken with the 26-inch refractor, using the occulting shutter. By this means good measurable images of Saturn were obtained, together with sufficiently exposed images of the reference stars. The field of the 26-inch on a 16 c.m. plate is one square degree, and the reference stars in this area were measured together with Saturn. The adopted places of these stars were deduced from measures made on the Astrographic reference plate, the constants of the reference plate being, as mentioned above, derived from all the available stars in the Astronomische Gesellschaft catalogues. The places of these reference stars, and therefore the deduced place of Saturn, will be affected by the mean systematic error of all the catalogue stars on the reference plate, and will thus be comparable with the deduced places of the satellite.

Five photographs were selected for measurement. From two to four images of Saturn and of each of the stars were measured on each plate in the Astrographic micrometer, and the following are the results obtained :—

Errors of N.A. Tabular Place of Saturn.

	Tab.—Obs. R.A.	Tab.—Obs. Dec.
	s	″
Aug. 10	– ·10	+0·0
25	– ·08	+0·2
25	– ·08	+0·1
27	– ·07	–0·2
30	– ·07	–0·1
Mean	– ·08	+0·0

Corrections for these mean errors have been applied to the tabular places of Saturn as already stated.

It may be mentioned that on six nights, August 25, 28, 29, 30,

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September 2 and 4, duplicate photographs with Saturn at the centre of the field were taken with exposures of 90 to 100 minutes in a search for Themis, which could not be found on these photographs, although taken under favourable conditions.

Royal Observatory, Greenwich:
1909 *January* 8.

Observations of Occultations of Stars by the Moon, made at the Royal Observatory, Greenwich, in the Year 1908.

(*Communicated by the Astronomer Royal.*)

Day, 1908.		Phenomenon.		Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation.	Observer.
							h m s	
Mar. 12	(*a*)	Disapp.	B.D. +22°, 1780	Astrographic Equatorial	225	Dark	6 50 53·76	A. L.
13		,,	Piazzi VIII., 121	,, ,,	225	,,	6 55 31·78	W. S.
13	(*b*)	,,	B.D. +20°, 2154	,, ,,	225	,,	7 5 27·16	W. S.
13		,,	39 Cancri	,, ,,	225	,,	7 13 54·57	W. S.
13		,,	40 Cancri	,, ,,	225	,,	7 20 0·08	W. S.
13		,,	,,	Sheepshanks Equatorial	100	,,	7 20 0·03	J. E.
13		,,	B.D. +20°, 2161	Astrographic Equatorial	225	,,	7 20 7·76	W. S.
13	(*b*)	,,	B.D. +20°, 2169	,, ,,	225	,,	7 25 50·62	W. S.
13		,,	B.D. +20°, 2174	,, ,,	225	,,	7 50 25·49	W. S.
13		,,	B.D. +20°, 2179	,, ,,	225	,,	8 1 41·94	W. S.
13		,,	Bradley, 1228	Sheepshanks Equatorial	100	,,	8 28 7·63	W. S.
23		Reapp.	Bradley, 2162	Astrographic Equatorial	225	,,	16 48 9·05	J. S.
Apr. 7		Disapp.	B.D. +22°, 1420	,, ,,	225	,,	7 8 7·91	W. S.
7		,,	B.D. +22°, 1427	,, ,,	225	,,	7 45 14·49	W. S.
7	(*c*)	,,	B.D. +22°, 1432	,, ,,	225	,,	8 33 20·11	W. S.
7		,,	B.D. +22°, 1439	,, ,,	225	,,	8 34 45·87	W. S.
7		,,	B.D. +22°, 1446	,, ,,	225	,,	9 1 55·22	W. S.
7		,,	B.D. +22°, 1448	,, ,,	225	,,	9 23 10·92	W. S.
7		,,	B.D. +22°, 1450	,, ,,	225	,,	9 37 5·95	W. S.
7		,,	B.D. +22°, 1453	,, ,,	225	,,	9 58 6·70	W. S.
7		,,	B.D. +22°, 1451	,, ,,	225	,,	9 59 55·91	W. S.
8		,,	B.D. +22°, 1721	,, ,,	225	,,	8 45 54·68	W. S.
May 9		,,	B D. +13°, 2280	,, ,,	225	,,	10 8 4·67	W. S.
Sept. 17	(*d*)	Reapp.	B.D. +22°, 1213	Altazimuth	160	,,	11 49 39·71	A. C.
Nov. 9	(*e*)	,,	ε Tauri	Sheepshanks Equatorial	100	,,	9 20 21·68	R. C.

(*a*) Observation doubtful, clouds passing. (*b*) Faint.
(*c*) Star glided along limb.
(*d*) Star reappeared while Moon was being observed with instrument in position 70° r.
(*e*) Observation doubtful, could not hear clock.

The apertures of the telescopes used are as follows:—

Astrographic Equatorial (guiding telescope)	10	inches.
Altazimuth	8	,,
Sheepshanks Equatorial	6¾	,,

The initials A. C., J. S., W. S., J. E., R. C., A. L., are those of Mr. Crommelin, Mr. Storey, Mr. Stevens, Mr. J. Evans, Mr. Cullen, and Mr. Lyne.